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Comet and Asteroid Dynamics

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109

Donald K. Yeomans

Strategy

In order to provide the ground-based observing community and NASA flight projects with accurate comet and asteroid ephemerides, improvements are being made to the existing dynamic models and new data types are being investigated. For active comets, nongravitational forces must be taken into account; these forces are assumed due to the rocket-like thrusting of outgassing cometary ices.

Progress and Accomplishments

New orbital solutions were computed for the dozen well observed near-Earth asteroids suspected of being inactive comets. For ten of these objects, the orbital improvements included the use of radar observations. For 1862 Apollo and 1566 Icarus, the existing optical and radar data could not be fit without the use of the outgassing acceleration model that is usually employed only for active comets. For asteroid 1566 Icarus in particular, the RMS orbit residuals and predictive capability of the computed orbits improved with the use of these nongravitational effects.

During 1990-1991, radar ephemeris predictions were provided for asteroids 1580 Betulia, 1989 JA, 1989 PB, 1917 Cuyo, comet 1989 c1 Austin, as well as for Mercury, Venus, Mars, Saturn, Titan, and Iapetus. Ephemeris information for approximately two dozen comets and asteroids were provided to observers both outside of, and within, the NASA community.

Simplified procedures were developed to allow the coordinate conversions of astrometric observations, ephemeris positions, and orbital elements between the B1950 and J2000 coordinate systems. These procedures involve only simple matrix manipulations and are symmetric in the sense that a conversion from B1950 to J2000 and from J2000 back to B1950 will reproduce the original initial conditions. These procedures will be adopted by IAU Commission 20 for use after January 1, 1992 -- when the community of comet and asteroid researchers will switch from the currently employed B1950 coordinate system to the J2000 system.

Projected Accomplishments

Because radar data has been shown to dramatically improve the orbits of many comets and asteroids, new orbital solutions will be performed for all comets and asteroids for which radar and optical astrometric data exist. Accurate comet and asteroid ephemeris information will continue to be provided to the community of observers (ground-based, Earth-orbital, and NASA flight projects).

Publications

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